PARTIAL TRANSLATION OF JAPANESE UNEXAMINED PATENT PUBLICATION (KOKAI) NO. 9-266105

SCOPE OF CLAIM FOR PATENT

1. A thermistor comprising:

chip-type thermistor element (12) formed by stacking and bonding a plurality of thin plate materials (11) of ceramic sintered body;

a plurality of resistance regulating electrodes (13, 53) formed on the surface and within thermistor element (12) and exposed at the end surfaces of thermistor element (12); and

terminal electrodes (14) formed on both ends of thermistor element (12) including end surfaces of thermistor element (12) and connected to resistance regulating electrodes (13, 53),

wherein thin plate materials (11) are stacked each other and bonded with insulating adhesive (16), and the surface of thermistor element (12) excluding its end surfaces are covered with insulating polymeric coating (17).

2. The thermistor according claim 1, wherein the plurality of thin plate materials are ceramic sintered body containing one or more of metal oxide selected from the group consisting of metal oxides containing Mn, Co, Cu, Fe, Al, and Ni, and the compositional ratio of the metals oxides in the thin plate materials is different from each other.

3. A method for manufacturing a thermistor, comprising:

forming a plurality of resistance regulating electrodes (13) on the surface of a plurality of thin plate materials (11) of ceramic sintered body, said resistance regulating electrodes are located at a predetermined interval and aligned in parallel with each other;

stacking and bonding thin plate materials (11) having a plurality of resistance regulating electrodes (13) thereon, with each other by insulating adhesive (16) to form laminate (18);

applying an insulating polymeric paste on the surface of laminate (18), and then drying and baking said laminate to form coated laminate (19);

dividing coated laminate (19) into a plurality of strips by cutting coated laminate (19) in the direction perpendicular to the lengthwise direction of said resistance regulating electrode;

applying an insulating polymeric paste on the cut surface of the coated strips (19), and then drying and baking said strips to form coated strips (22);

dividing the coated strips into chips by finely cutting the coated strips (22) in a direction parallel to the width direction of internal resistance regulating electrode (13) and along the center line of the respective internal resistance regulating electrode (13) to form a plurality of thermistor elements (12) with said resistance regulating electrodes are exposed at both ends;

forming electrode layers (23) on both ends of thermistor element (12), including both end surfaces of thermistor element (12) and one end of each of resistance regulating electrodes (13); and

forming plating layer (24) on the surface of electrode layer (23) to complete terminal electrode (14) consisting of electrode layer (23) and plating layer (24).

4. A method for manufacturing a thermistor, comprising:

forming a plurality of resistance regulating electrodes (13) on the surface of a plurality of thin plate materials (11) of ceramic sintered body, said resistance regulating electrodes are located at a predetermined interval and aligned in parallel with each other;

stacking and bonding thin plate materials (11) having a plurality of resistance regulating electrodes (13) thereon, with each other by insulating adhesive (16) to form laminate (18);

dividing laminate (18) into a plurality of strips by cutting laminate (18) in the direction perpendicular to the lengthwise direction of resistance regulating electrode (13);

applying insulating polymeric paste on the surface of strips (71), and then drying and baking said laminate to form coated strip (22);

dividing coated strip (22) into chips by finely cutting coated strip (22) in a direction parallel to the width direction of internal resistance regulating electrode (13) and along the center line of the respective internal resistance regulating electrode (13) to form a plurality of thermistor elements (12) with said resistance regulating electrodes are exposed at both ends;

forming electrode layers (23) on both ends of thermistor element (12) including both end surfaces of thermistor element (12) and one end of each of resistance regulating electrodes (13); and

forming a plating layer (24) on the surface of electrode layer (23) to complete terminal electrode (14) consisting of electrode layer (23) and plating layer (24).

DETAILED DESCRIPTION OF THE INVENTION (Excerpt)

[0001] TECHNICAL FIELD OF THE INVENTION

The present invention relates to thermistors for temperature compensation of various electronic devices and thermistors suitable as sensors for measuring the surface temperature of various electronic devices, and the method for manufacturing the same. More particularly, the preset invention relates to thermistors adapted for surface mounting on printed circuit boards and the method for manufacturing the same.

[0009] It is an object of the invention to provide a thermistor which enables broadening of the range of thermistor characteristics such as resistance and B constant by increasing the adjustment range of resistance, easy acquisition of a low resistance and a high B constant, and achievement of sufficient mechanical strength by preventing generation of micro-cracks, and the like, and a method for manufacturing the same. Another object of the present invention is to provide a thermistor which enables improvement of the original functional accuracy by decreasing the fluctuation of the resistance, and decreasing the fluctuation of the thermistor characteristics during heat-curing of the coating covering the surface of the thermistor element, and a method for manufacturing the same.

[0011] The adjustment or reduction of the resistance of the thermistor according to claim 1 of the present invention can be easily achieved, because this thermistor has resistance regulating electrodes 13 on the surface and interior of thermistor element 12. Therefore, a thermistor 10 having a thermistor characteristic of low resistance and high B constant can easily be obtained. Further, the heat load on the thermistor element 12 can be minimized and the fluctuation of the thermistor characteristics such as resistance and B constant can be reduced, because the surface of thermistor element 12 is coated with polymeric coating 17 which is able to be heat-cured at a relatively low temperature.

[0027] After applying an epoxy-based frit Ag electrode paste on each side of the thermistor element 12 including the side surface of thermistor element 12 and the side surface of resistance regulating electrode 13 by a dip coating technique, the thermistor was heated to 250°C for 30 minutes to form electrode layer 23 on the both side of thermistor element 12. Then, plating layer 24 was formed on the surface of electrode layer 23 (Fig. 6). Plating layer 24 comprised Ni plating layer 24a having a thickness of from 2 to 5 μm formed on electrode layer 23 by electrolytic barrel method and solder plating layer 24b having a thickness of from 3 to 7 μm formed on the surface of electrode layer 24a. A chip-type thermistor 10 illustrated by Fig. 1(g) and Fig. 6 was obtained by such procedure.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates the steps for manufacturing a thermistor according to the first embodiment of the present invention.

Fig. 2 is a cross sectional view taken along line A-A of

Fig. 1.

Fig. 3 is a cross sectional view taken along line B-B of Fig. 1.

Fig. 4 is a cross sectional view taken along line C-C of Fig. 1.

Fig. 5 is a cross sectional view taken along line D-D of Fig. 1.

Fig. 6 is a cross sectional view taken along line E-E of Fig. 1.

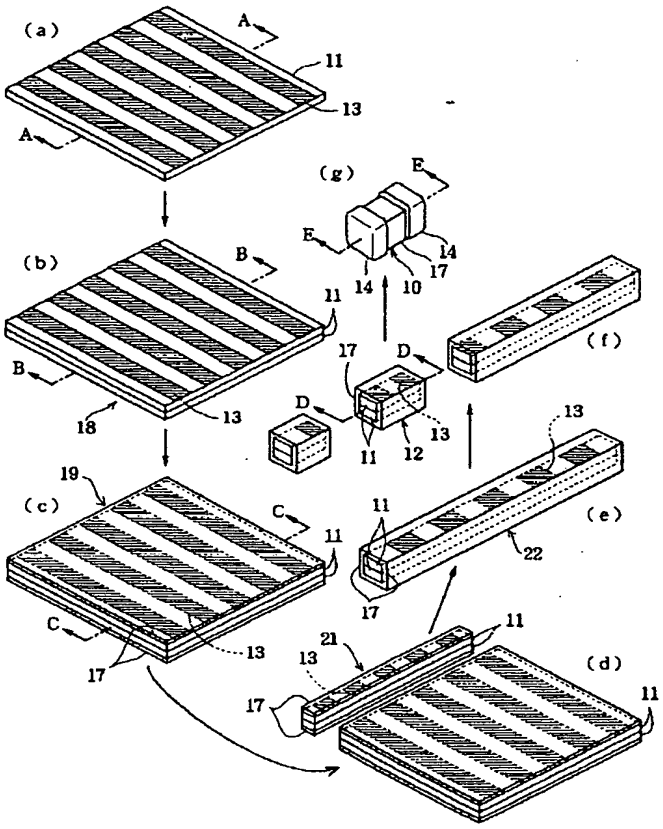
Fig. 7 is a cross sectional view of a thermistor according to a second embodiment of the present invention.

Fig. 8 illustrates the steps for manufacturing a thermistor according to a third embodiment of the present invention.

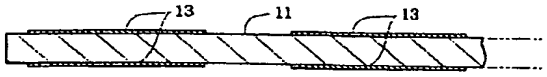
Reference Numerals of the Drawings:

10, 50, 70	Thermistor
11	Thin plate material
12	Thermistor element
13, 53	Resistance regulating electrode
14	Terminal electrode
16	Insulating adhesive
17	Polymer coating
18	Laminate
19	Coated laminate
21, 71	Strip
22	Coated strip
23	Electrode layer
24	Plating layer

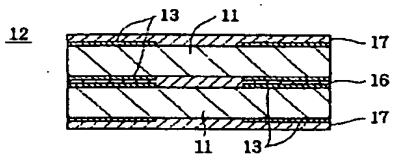
[Fig. 1]



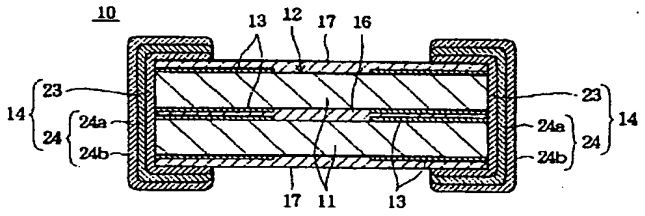
[Fig. 2]



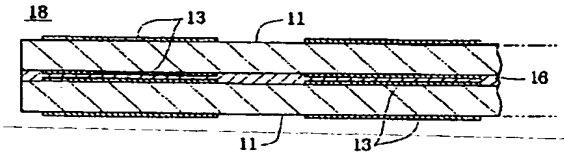
[Fig. 5]



[Fig. 6]



[Fig. 3]



[Fig. 4]